

JPL IGS ANALYSIS CENTER REPORT, 2001-2002

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Summary

Four GPS orbit and clock products are currently provided by JPL for consideration by the IGS. Each differs in its latency and quality, with later results being more accurate. Results are typically available in both IGS and GIPSY formats via anonymous ftp. The biggest recent improvements have been due to larger and better distributed tracking networks including an upgrade of the Flinn network from 42 to 60 sites. Current performance based on comparisons with the IGS final products and daily repeatability is summarized in Table 1.

Table 1: Product Quality

Products	Delivery	Orbit	Clock	N	E	V	Positions
Final-Flinn	Weekly	4.6 cm	3.8 cm	2.7	3.2	6.6	mm
Rapid	Daily	6.3 cm	7.7 cm	3.6	4.5	6.9	mm
Ultra-Rapid	Twice per day	13.4 cm	73.1 cm	10.3	20.2	22.6	mm
Real-Time	Every 15 minutes	24.0 cm	31.8 cm	28.3	43.0	69.1	mm

Recent Improvements

Continuous strategy improvements are listed in Table 2. In addition to the tracking network upgrade, the reference frame is now ITRF2000, new IERS tidal models are in place, ocean loading has been improved twice, IERS tides and sub-daily polar motion models have been implemented, and numerous other refinements have been made.

Table 2: Strategy Updates

Action	Date
Add AMC2 reference clock candidate	08/27/02
Ocean loading upgrade - FES02	07/23/02
Add extra digit to jpl.txt and sp3 files	07/15/02
Add USN1 reference clock candidate and new hi-rate clock script	06/17/02

Add extra digit in eci files	05/27/02
Increase Flinn tracking network from 42 to 60 sites	04/07/02
Ocean loading upgrade - FES99	03/03/02
New ITRF2000 nominal coordinate database	01/25/02
Expand Flinn high rate clocks from 27 to 30 hours	01/20/02
IERS2000 tidal models	120/2/01
ITRF2000 / IGS00 reference frame	12/02/01
Tighten edit window from 5 m and 5 cm to 2 m and 2 cm	05/06/01
Update P1-C1 corrections	02/18/01
Announce availability of 15 minute real-time products	11/21/00
IERS sub-daily EOP model	11/12/00

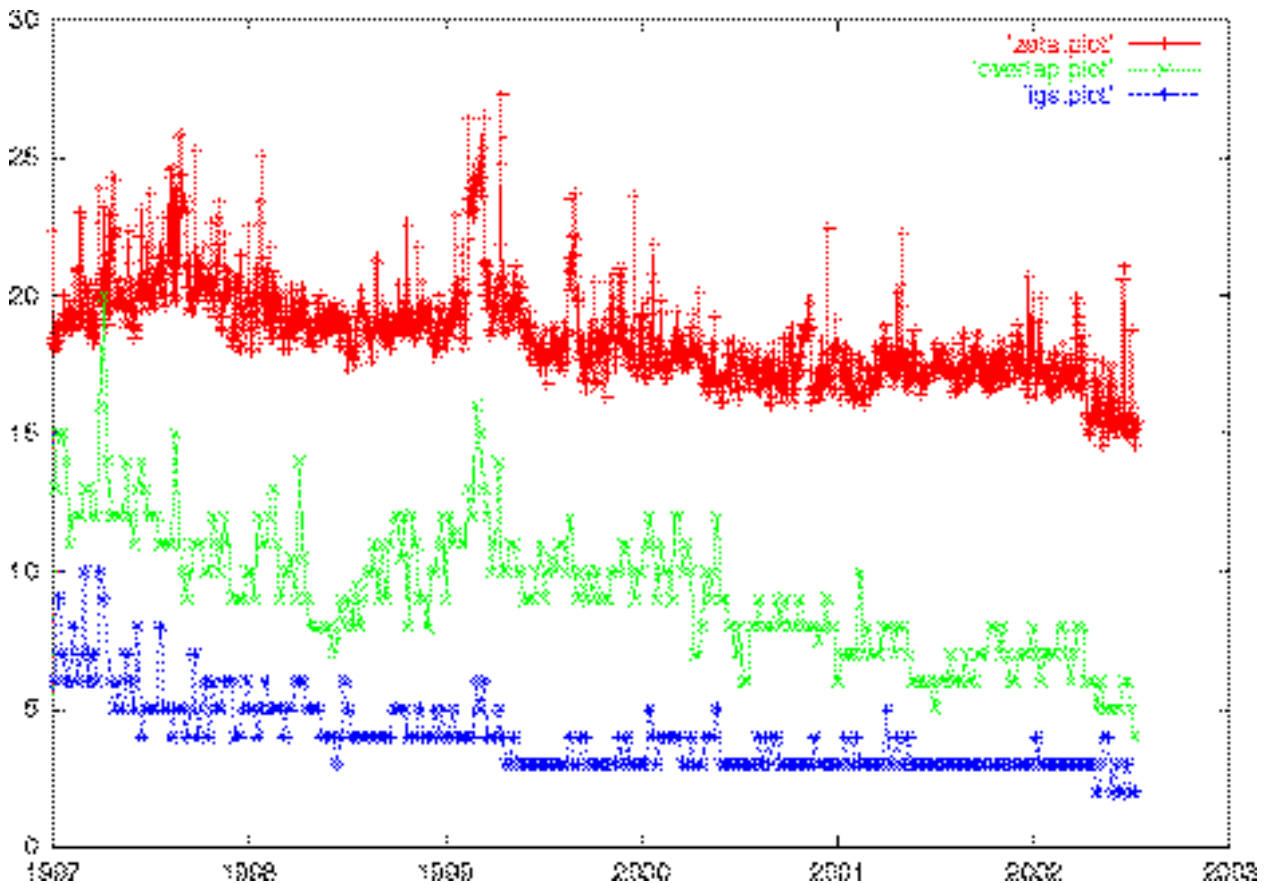


Figure1: Performance Metrics

Figure 1 shows the three main metrics used for monitoring performance; (1) Zeta in hundreds of km is representative of the site distribution density, (2) Three dimensional orbit overlaps from day to day in cm, and (3) One dimensional IGS orbit comparisons in cm. All metrics have improved over time. There is a significant correlation between

tracking site distribution and orbit quality. Most strategy upgrades lead to small but cumulative improvement. The most sudden performance increase visible on the plot is due to expansion of the Flinn tracking network from 42 to 60 sites, leading to best ever values of zeta, overlaps, and IGS comparisons of 1453 km, 4 cm, and 2 cm respectively.

Flinn orbits and clocks are fixed to compute point positions for hundreds of additional sites around the world. Figure 2 shows the growth of point positioning over time from roughly 20 sites per day in 1991 to more than 500 sites per day in 2002. JPL currently computes time series for the IGS, SCIGN, CORS, NBAR, and PANGA networks. These time series provide insight into global plate motion, post-glacial rebound, seasonal loading, co- and post-seismic deformation due to earthquakes, and interseismic strain accumulation in active boundary zones such as Southern California. The current global velocity field is illustrated in Figure 3.

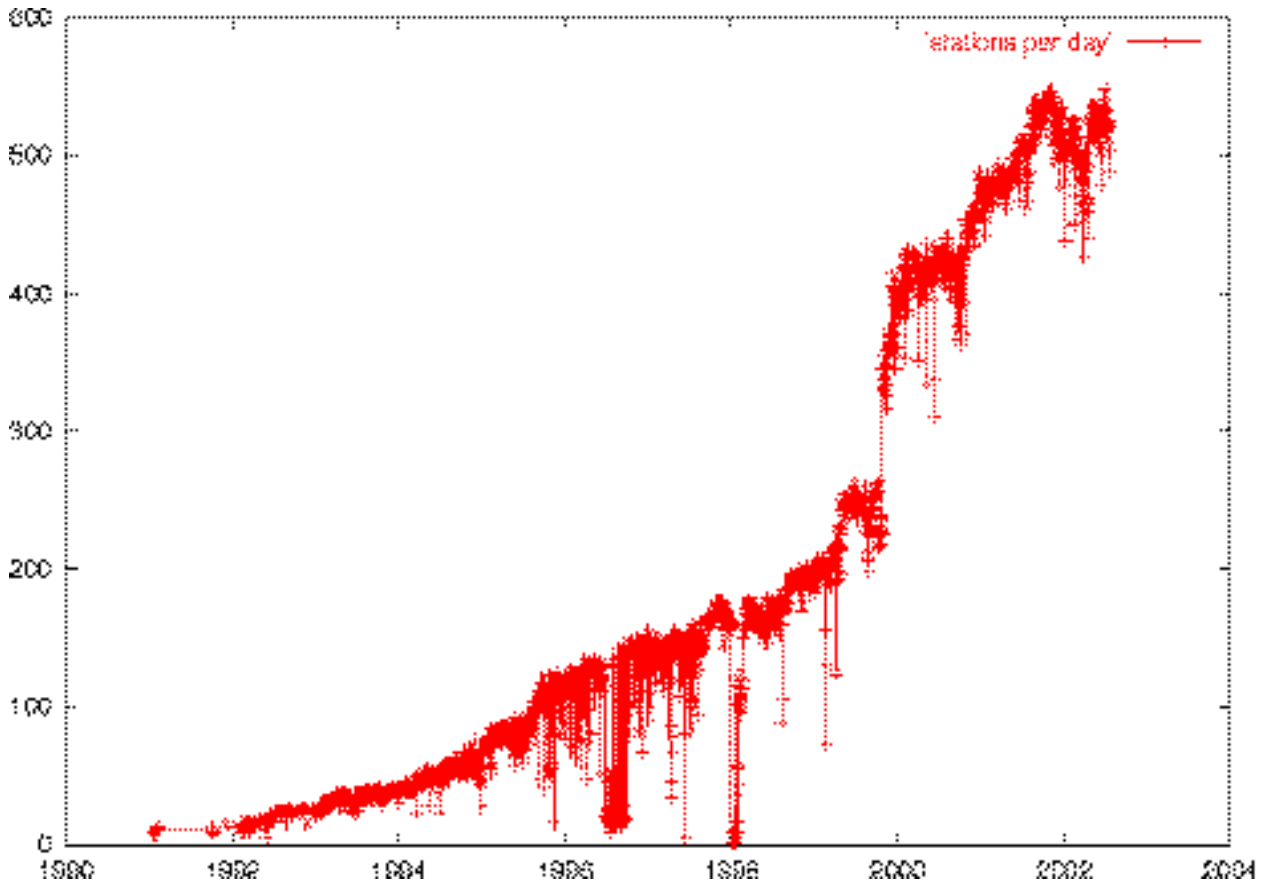


Figure2: Point Positions Per Day

Products

Various products are made available via ftp and http. A list of available information is provided in Table 3. There are four major orbit and clock products. Post-processing

based on Flinn products is used to derive our final time series of polar motion, length of day, geocenter, scale, and site position [1].

Table 3: Product Files

Real-Time Products

ftp://sideshow.jpl.nasa.gov/pub/15min
jpl11583.clk.Z
jpl11583.sp3.Z
jpl11583.tro.Z
jpl11583.yaw.Z
2002-03-20.TPNML.Z
2002-03-20.eci.Z
2002-03-20.gps_clocks.Z
2002-03-20.yaw_rates.Z

Ultra-Rapid Products

ftp://sideshow.jpl.nasa.gov/pub/gipsy_products/UltraRapid
jpu11583.erp
jpu11583.sp3.Z
jpu11583.sum
2002-03-20.TPNML.Z
2002-03-20.eci.Z
2002-03-20.gps_clocks.Z
2002-03-20.shadow_events.Z

Rapid Products

ftp://sideshow.jpl.nasa.gov/pub/gipsy_products/RapidService
jpl11560.clk.Z
jpl11560.sp3.Z
jpl11560_pred.sp3.Z
jpl11560_pred_pc.sp3.Z
2002-03-03.DONE
2002-03-03.PREDICT
2002-03-03.TPNML.Z
2002-03-03.TPNML.predict.Z
2002-03-03.eci.Z
2002-03-03.eci.predict.Z
2002-03-03.eci.predict.edited.Z
2002-03-03.frame

2002-03-03.gps_clocks.Z
2002-03-03.gps_clocks_hr.Z
2002-03-03.shadow_events.Z
2002-03-03.sta_clocks_hr.Z
2002-03-03.yaw_rates.Z

Final-Flinn Products

<ftp://sideshow.jpl.nasa.gov/pub/jpligsac/1156>
jpl11560.clk.Z
jpl11560.sp3.Z
jpl11560.tro.Z
jpl11560.yaw.Z
jpl11567.erp.Z
jpl11567.snx.Z
jpl11567.sum.Z

ftp://sideshow.jpl.nasa.gov/pub/gipsy_products/2002
2002-03-03.eci.Z
2002-03-03.frame
2002-03-03.shad.Z
2002-03-03_nf.eci.Z
2002-03-03tpeo.nml.Z
2002-03-03tpeo_nf.nml.Z
2002-03-03.tdpc.Z
2002-03-03_nf.tdpc.Z

Time Series

<http://sideshow.jpl.nasa.gov/mbh/series.html> - web page with links to tables, plots, and ftp areas

<ftp://sideshow.jpl.nasa.gov/pub/mbh/point> - IGS, SCIGN, CORS, NBAR, and PANGA
<ftp://sideshow.jpl.nasa.gov/pub/mbh/filtered> - ambiguity resolved, regionally filtered SCIGN
<ftp://sideshow.jpl.nasa.gov/pub/mbh/stacov> - ambiguity resolved SCIGN stacov files

Time series are given as three ASCII files SITE.lat, SITE.lon, and SITE.rad containing the time in years, estimate in cm, sigma in cm, site, component, and date. Stacov files contain X, Y, Z estimates in m, sigmas in m, and correlations.

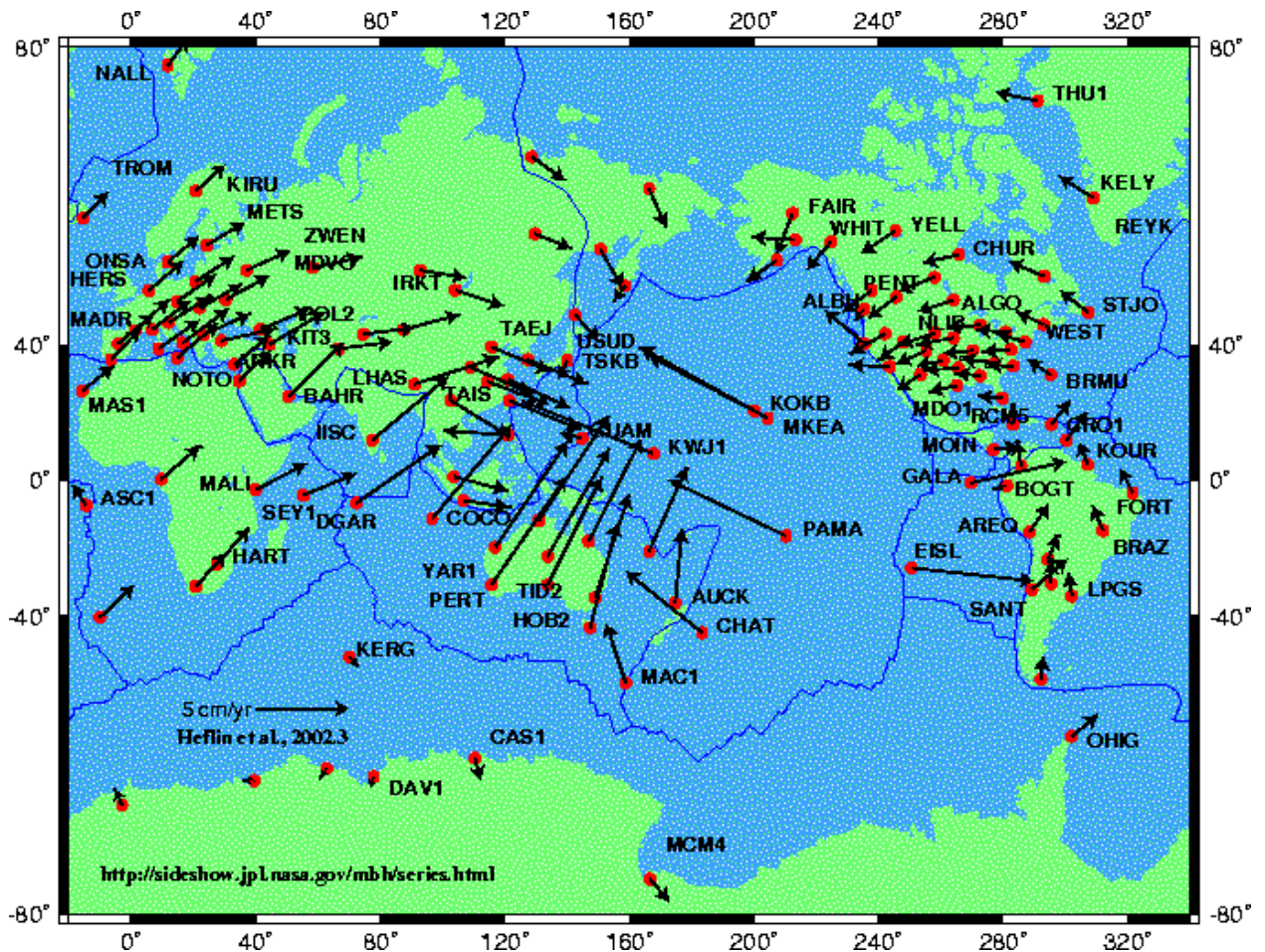


Figure 3: Global GPS Velocity Field

Acknowledgment

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References

- [1] M. Heflin, D. Argus, D. Argus, D. Jefferson, F. Webb, J. Zumberge, Comparison of a GPS Defined Global Reference Frame with ITRF2000, GPS Solutions, 2002.